

PROJECT REPORT

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Interaction Design

Bachelor in Applied Information Technology

Université du Luxembourg

03/07/2022



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Introduction

In the course *Software Engineering Project*, we were asked to develop a program whose target was to promote the Faculty of Science, Technology and Medicine (FSTM) of the University of Luxembourg. Taking the approach of interaction design, this report analyzes and records our project with user requirements specification, project diary and testing plan.

1 User Requirements Specification

1.1 User Requirements

The program should be informative about the faculty. The functional requirement of the project is that it should deliver information about the departments to the users. Since the users can have access to all the departments' information on the official websites, why do they need our application?

To find out the answer, we need to study the users needs and compare our project to the university website. As informative as the official websites are, they are not interactive enough. We want to make something different that can better motive users' engagements. Study[1] (Christiano and Neimand, 2017) shows that the awareness-raising campaigns are labor consuming and not likely to have a better result. As Christiano and Neimand [2] (2018) suggest, some of the good strategies of making people involved in an activity is to let them join the community, to communicate in images, and to invoke emotion with intention. Firstly, images can be greatly helpful in our case. Compared to the university homepage, what we lack is something much more graphic, more vivid and more interesting. As a result, a game can be effective in our case. Secondly, the project should make users feel as a part of our community, FSTM. Our program should create a sense of community that includes our users in it, and let them feel free to explore around in the virtual community we build in the program. Lastly, to intentionally invoke user's emotion, the application can build connection between the users and the community and let them feel that things on Belval are relevant to them. To sum up, the functional requirements is that our product should provide FSTM information to the users, in a graphic, inviting and emotion-invoking way.

As for non-functional requirements, we focus on the characteristics of the users. Our intended user groups are the members and potential new members of the faculty, including students and staff. The characteristic of these users is that they are already interested in the University of Luxembourg or in other universities. They probably already know something about the university. Therefore, our project should try to provide the users with another perspective to get to know our faculty to provide an experience that they cannot have from other sources.

To use the application, the users should not be required specific skills except some knowledge in English. The language of the system should be in English since it is the working language of the university and it is the language of academia.

1.2 Usability Criteria

According to the analysis on users before, the following usability criteria is suitable to our context. These usability criteria is further discussed in Chapter Three about the testing plan, to verify if they have been correctly implemented to satisfied the users' needs. The usability criteria are as follows:

- The graphical user interface (GUI) should be easy to understand and to use. It should be flexibly adapted to most of the phone sizes.
- The game should be easy to understand and to complete for every user, no matter they are experienced gamers or not.
- In terms of performance, the game should be responsive and acceptable by most of the mobile phones, with short loading time and without any frames-per-second drop.
- The navigation in the game should be precise and intuitive as a mobile phone game, which includes finger swipe, finger slide, touch screen, side-scrollbar-free, etc.
- The player movement controls should be adapted to the individual user. No matter where the user touches on the screen, they can control the moving direction of the player character in the game.
- Users should be able to understand how to play the game in a short time when they start the game.
- The users should be able to install and update the game in less five minutes.
- The game should be constant in each round, which means that if the player has already played through the game to the end, and they re-start it from the beginning and do the same things, then the game will go the same as before.
- The game should support the English language since it is mandatory in the university.

1.3 Conceptual Design

Based on the users' needs analysis above, we came up with two conceptual models to describe our system. Figure 1.3.1 represents our first design and Figure 1.3.2 the second version. Moreover, we present our conceptual design in the form of an UML class diagram as shown in Figure 1.3.3.

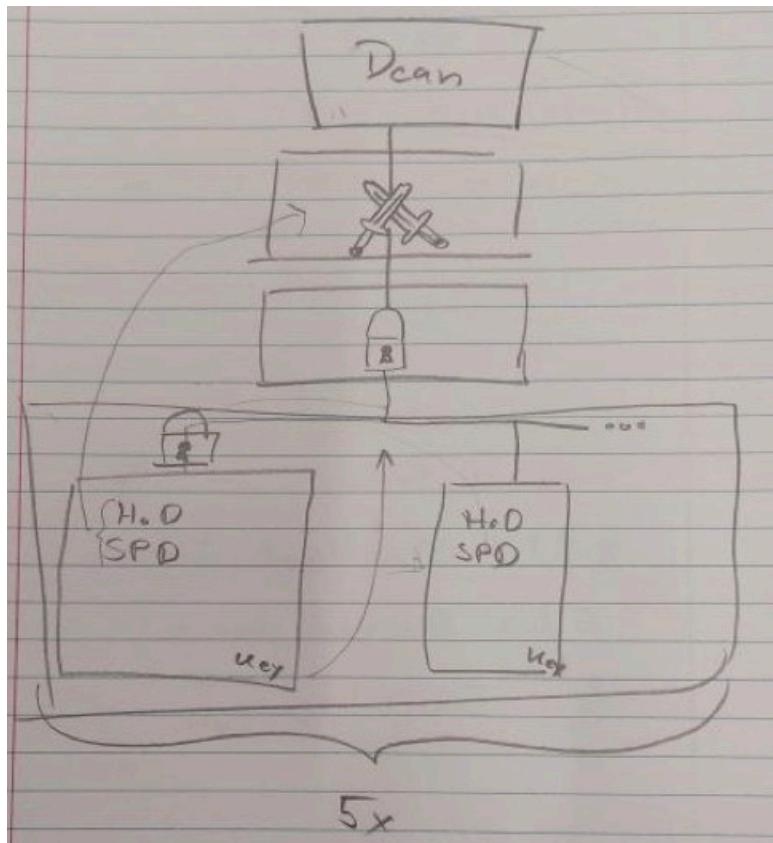


Figure 1.3-1 First Draft of Conceptual Design

In Figure 1.3-1, the lowest part contains five blocks, and each one of them corresponds to the five departments of FSTM, including mathematics, physics, engineering, computer science, biology and medicine. In these rooms, the player can capture some professors for later battles. They also need to either solve puzzles or complete a quest to collect five keys, with which they can unlock the door of the administration office, the one with the swords icon in it. Once the user gets there, they need to fight against the enemies and the final villain with the special power of the previously caught professors. When the villain is killed, the player is able to free the dean, and the game is considered completed.

The first design involves a lot of activities, such as solving puzzles, battling and catching professors. This model is interesting to play but time-consuming. Most importantly, it does not deliver much more faculty information than other modules. Consequently, we came up with the second design that concentrates on the information about the professors. It is like the mobile phone game Pokémon Go. The goal of this game is to collect all the professors, named PokéProf, in the game.

As illustrated in Figure 1.3-2, this model consists of an indoor part and an outdoor part. The exterior resembles Belval campus with five departments buildings, and each of them is composed of two floors. On the first floor, the player can find some Pokéballs and some non-player characters

(NPC). On the second one, there are some PokéProves that the player can capture with a tool called Pokéball. To capture them, he needs to have a Pokéball in his inventory slots. Once caught, the professors' information will be displayed on a board, Pokédex. We stress on the structure of the five buildings because when the player finds a professor in their department building, the user will know the professor's affiliation. Besides, as the research in users' requirement states the importance of including the player into our community, this structure can help us create a virtual community. By hanging around on the virtual Belval campus and in the FSTM buildings, the player becomes acquainted with our departments. Catching our professors and "owning" them in the Pokédex can also bring a closer connection between the player and our staff.

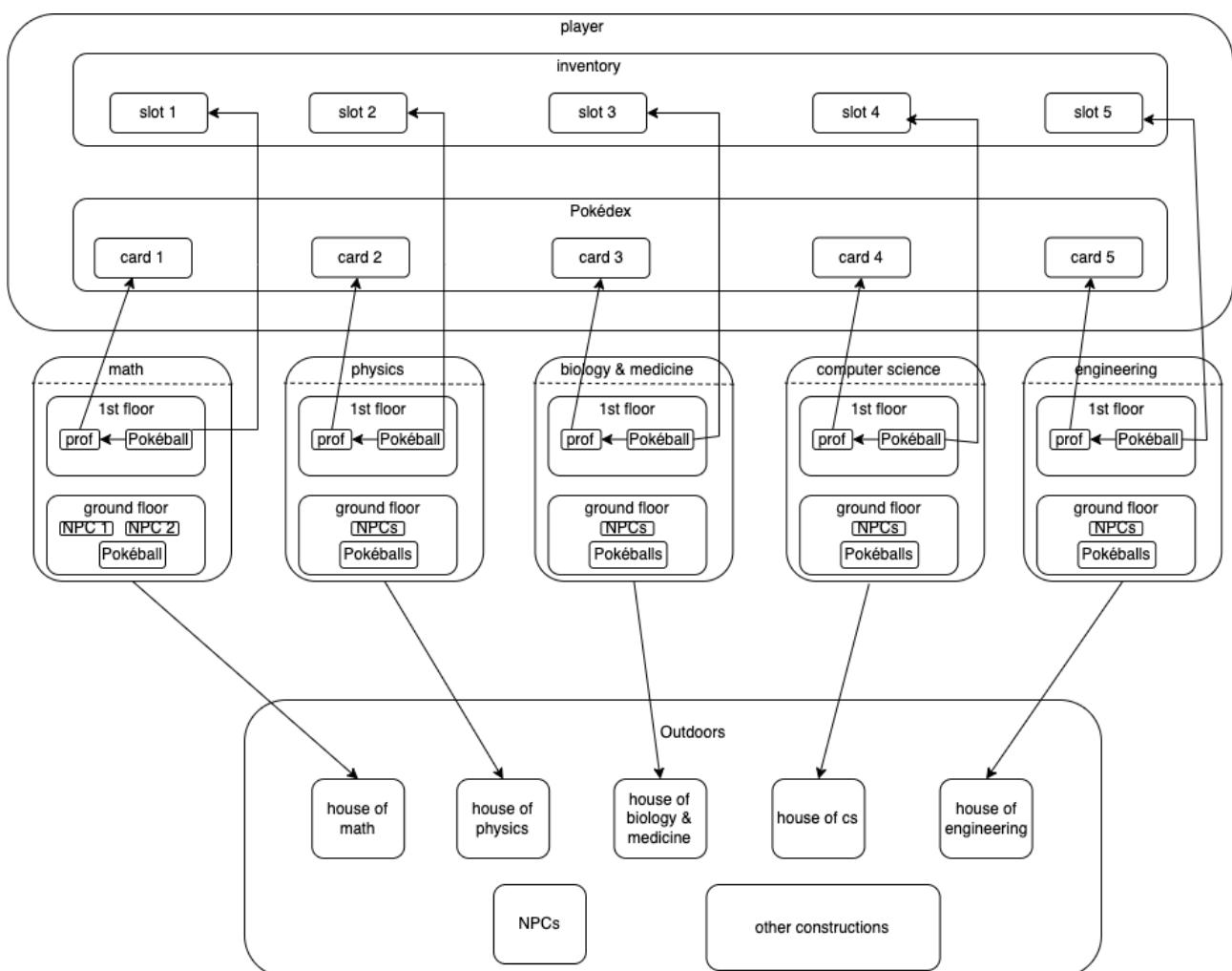


Figure 1.3-2 The Second Conceptual Design

The UML class diagram in Figure 1.3-3 is the transformation from the users' mental model of the system into a technical project description for the developers. It tells the developers what should the game do. It is based on the second conceptual design that we have finally decided to do about our application. The bottom lies all the departments, who have a department head and at least one course directors respectively. They are both described as PokéProves. Each of them has one card slot in the Pokédex. Their cards will be activated and visible if they are caught. The main character has one inventory that can hold items such as

Pokéballs, keys, etc. In the Poképroves class, we can see that there are some methods like `isCaptured()` to check if this staff has been captured.

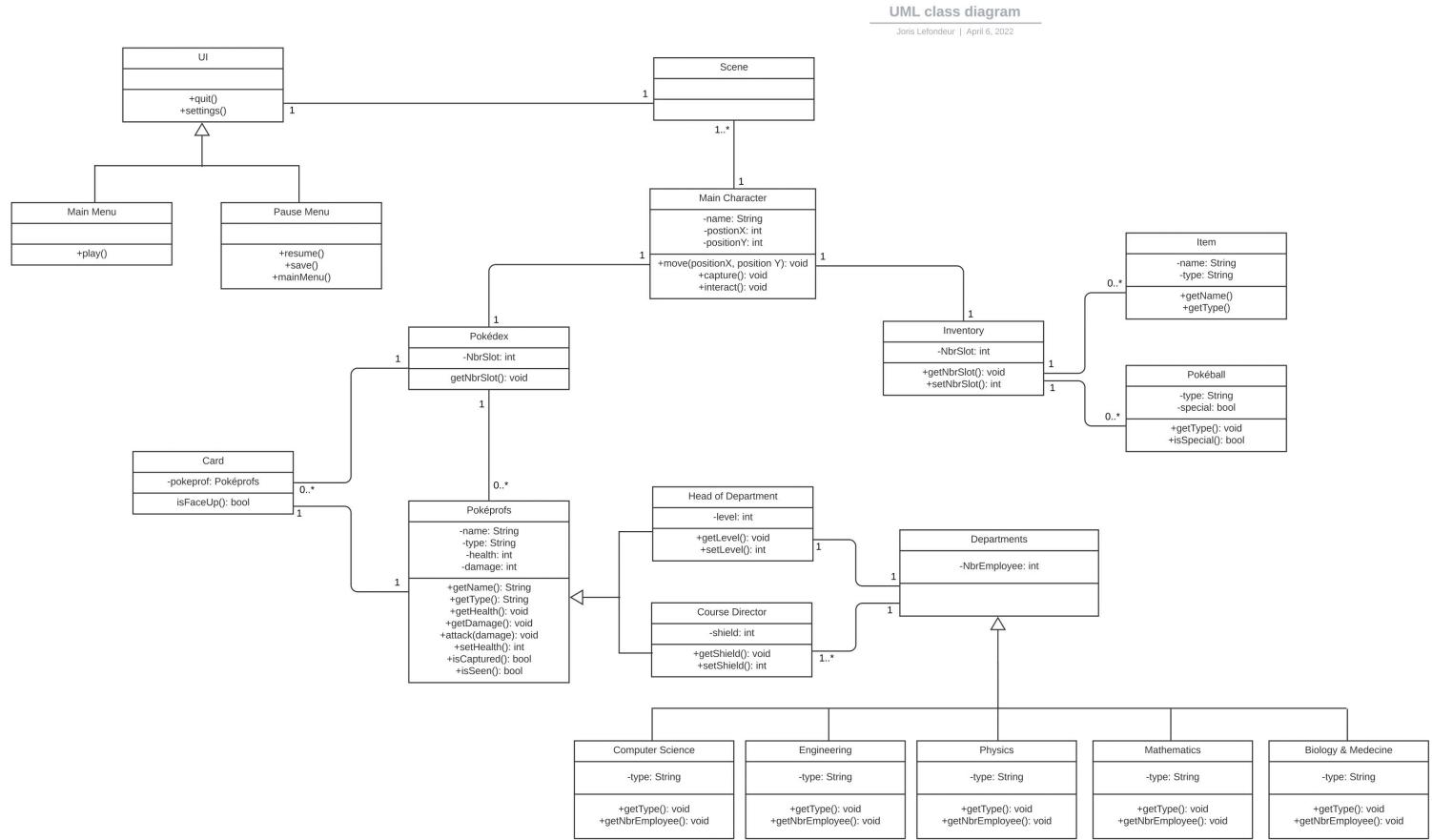


Figure 1.3-3 UML Class Diagram

1.4 Interaction Design

1.4.1 Blueprint of the Interaction Design

Our interaction design is achieved by the GUI in our game and all the interactions between them. Figure 1.4.1-1 presents the structure of the main menu and the following is its implementation in further details.

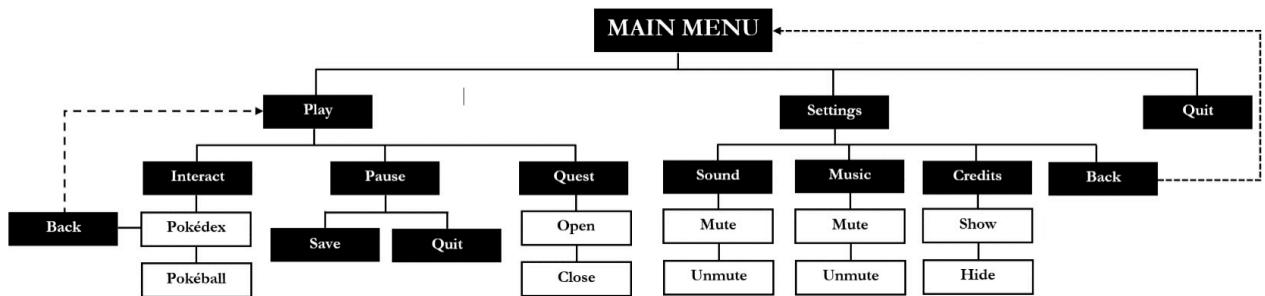


Figure 1.4.1-1 Structure of the Main Menu

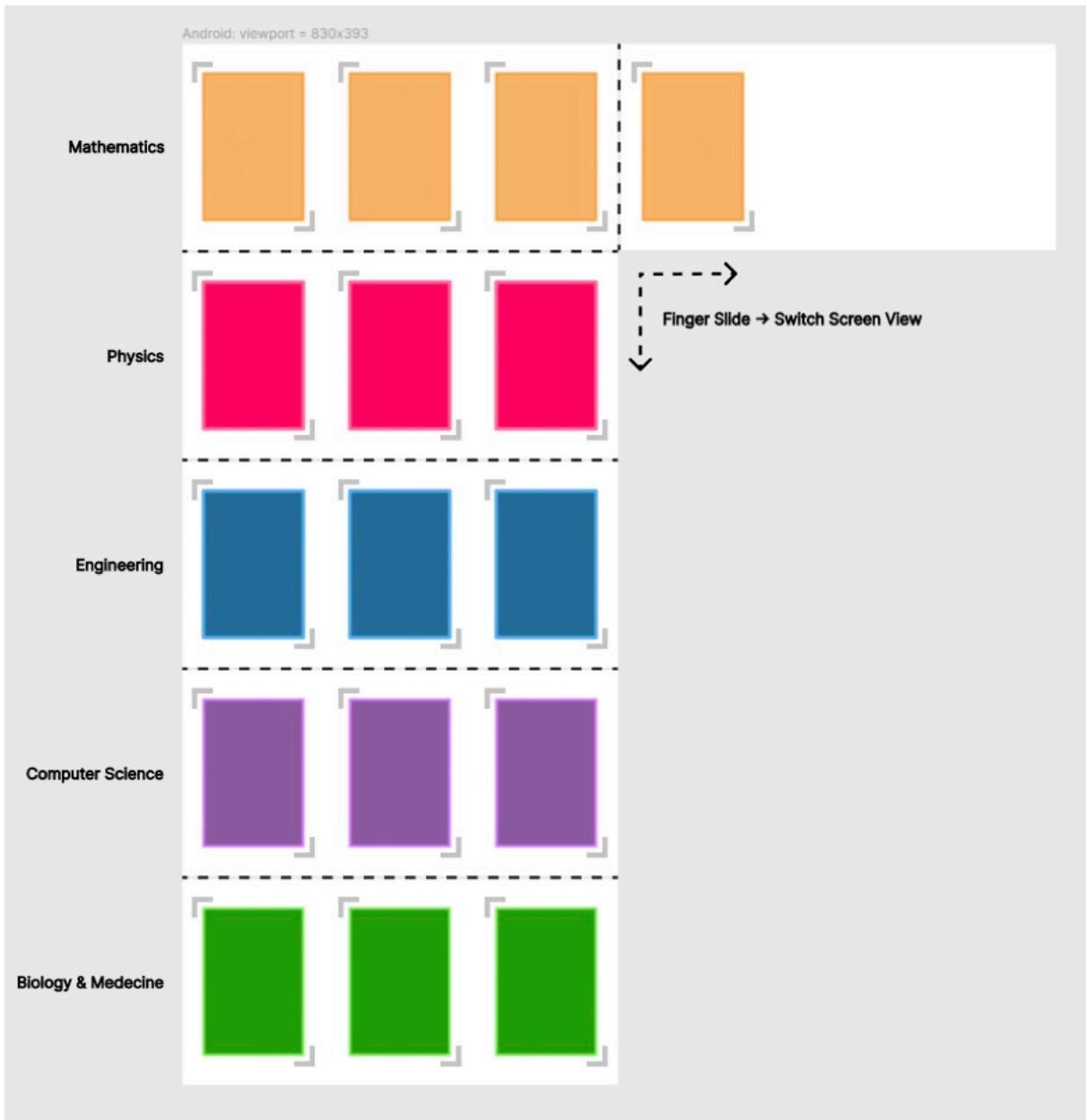


Figure 1.4.1-2 Pokédex Mockup

Figure 1.4.1-2 is the Pokédex layout concept design. Different cards for each Poképroves are sorted according to their departments. To navigate between each department, the user needs to tap the screen and slide upwards from the bottom. To switch among the professors in the department, they can slide vertically from left to right or the other way around. In addition, the edge of a card is trimmed by brighter colour to indicate whether the corresponding Poképrof is caught and the card is available to flip to display the professor's information.

We design that three is the maximum number of cards that can be displayed on a phone screen, otherwise the cards will be shrunk into a smaller size that is hard to read. If the user click on a card, the full screen will only display this card in portrait mode.

1.4.2 Implementation of the Menu and Settings

Figure 1.4.2-1 and Figure 1.4.2-2 show the implementation of the main menu and the settings user interface (UI).

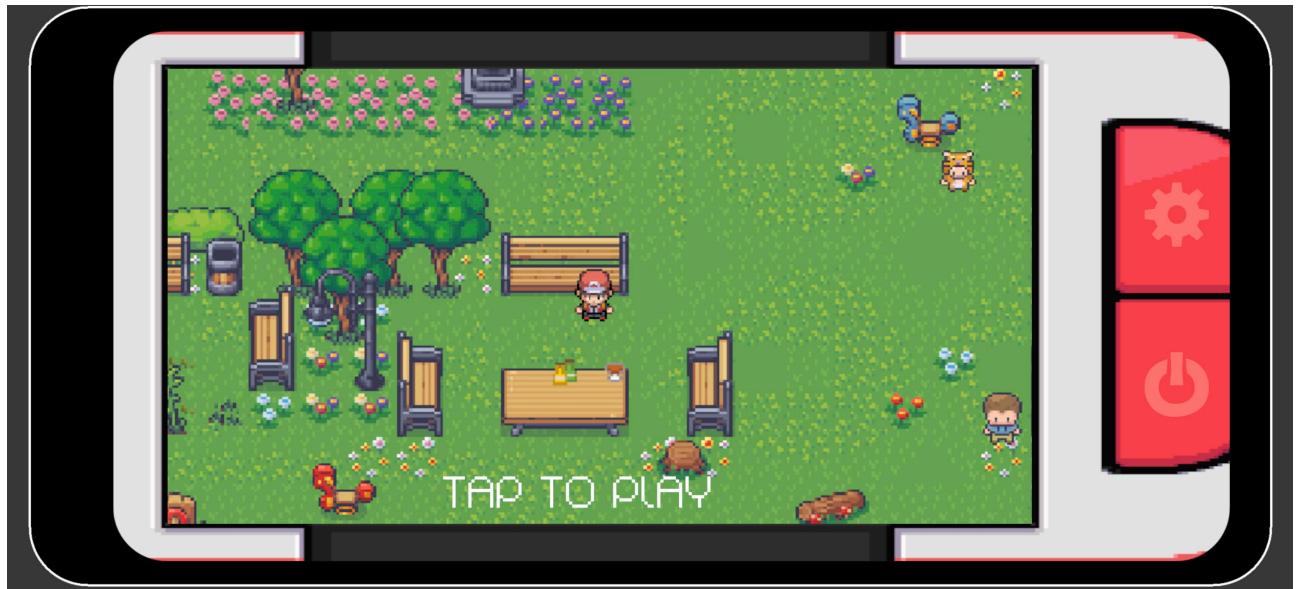


Figure 1.4.2-1 Main Menu UI

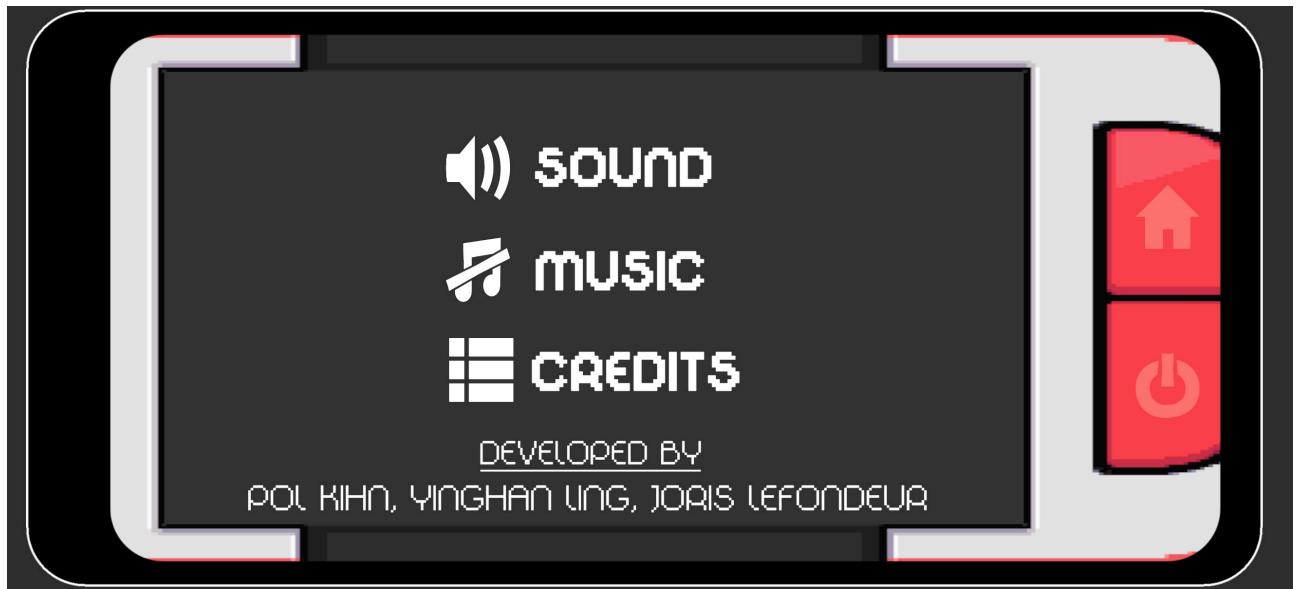


Figure 1.4.2-2 Settings UI

Figure 1.4.2-1 is the opening scene of the game. We tap on the majority of the screen to start playing, or we can also find a setting button and a quit button on the right side. The button icons are simple and easy to understand to facilitate user's interaction with the game. When the user touches the settings button, the interface will transition into the settings menu with three two-states buttons.

When the player enter the settings interface, the settings icon on the top right is replaced by a homepage icon to indicate that it can direct the interface to the main menu once being clicked. By tapping on the icon, the player can turn on or off the relevant functionality. For example, the music is off in Figure 1.4.2-2, and the user can turn it back on by touching the music icon.

1.4.3 Implementation of the Game GUI

We designed two versions of the game GUI. The first version is shown in Figure 1.4.3-1 If the user click the button of quests or inventory, their windows will be opened, occupying the majority of the screen as illustrated in Figure 1.4.3-2 When the pause button is clicked, the user can either save or quit the game.

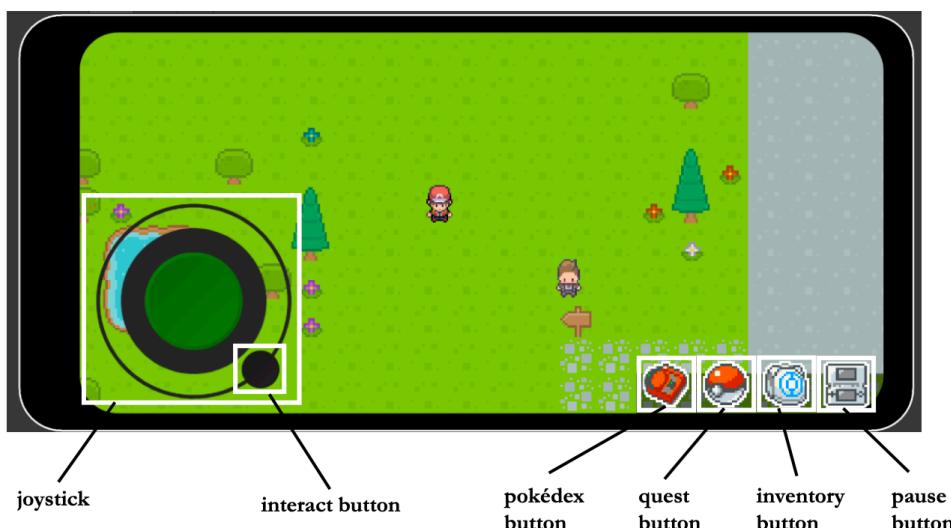


Figure 1.4.3-1 The First Version of the Game GUI



Figure 1.4.3-2 The First Version of the Quest Window and the Inventory Window

The first version of the GUI has an obvious disadvantage: each time the user wants to catch a catch a PokéProf, they need to stop and click the button of inventory to see whether they have the right Pokéball. Furthermore, during our early phase testing, we have received some feedbacks about the GUI from the users. We did some changes accordingly for better users' experience. Further details about why we have changed the UI can be found in the chapter of Testing Plan.

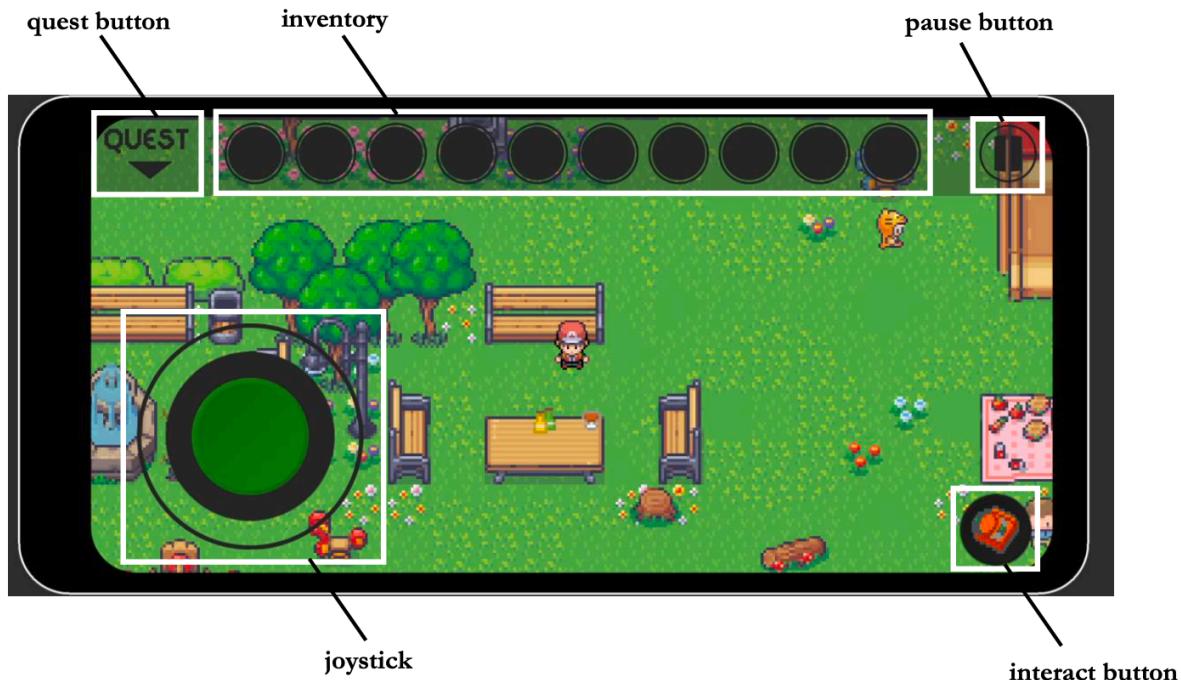


Figure 1.4.3-3 The Final Version of the Game GUI

One of the major changes in the final version is that we list out the objects in the inventory in the top bar so that the user does not need to click any button to know what is in his inventory, as shown in Figure 1.4.3-3. We move the quest tab right next to the top left. When the user clicks the quest button, quest tab is opened and displayed on the main screen just as in the first version (see Figure 1.4.3-4); and the arrow on the quest icon is changed from pointing downward to upwards, indicating that this list can be closed. When the pause button is clicked, the user can either save or quit the game.

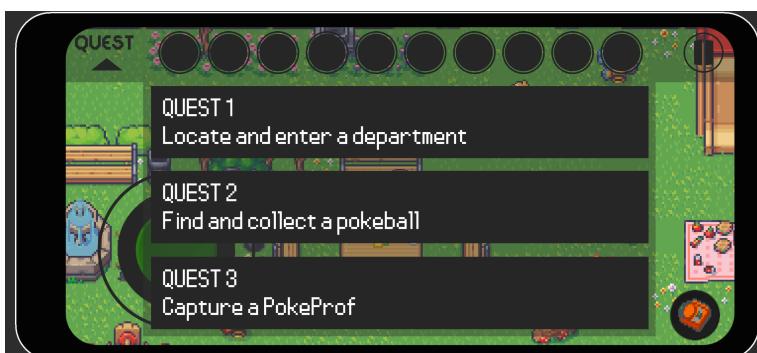


Figure 1.4.3-4 Final Version the Quest

1.4.4 Implementation of the Capture Game UI



Figure 1.4.4-1 The Interior of a Department Building

From Figure 1.4.4-1 above, we can see that the user has already collected some Pokéballs that are stored in the player's inventory, with a number beside indicating how many there are. When the user gets close to a PokéProf, the bottom right interact button becomes the image of the specific Pokéball that is necessary to capture this PokéProf. This graphic design provides the users with a quick and easy instruction.

The user can click on the Pokéball icon in the interact button area to trigger the capture game UI as in Figure 1.4.4-2.



Figure 1.4.4-2 Capture Game UI

In the capture game, the mobile phone screen will switch to portrait mode for better reading experience. At the top right we can notice a question mark icon for the case where the player does not know how to play. If the user clicks on it, an instruction will show up and tells them that they need to swipe the Pokéball with their finger to the Poképrof for the capture.

In terms of the UI of the Pokédex, originally the cards in the Pokédex are grey and the name of the department is hidden. They will become colorful with their name visible if the player walks into the corresponding department building, indicating that the user has explored an area, see Figure 1.4.4-3 below.



Figure 1.4.4-3 Pokédex UI Before and After the Department Explored

Once a PokéProf is caught, the user can find the border of their card lightens up, which indicates that the card can be flipped, and the information of the professor will be displayed as in Figure 1.4.4-4. Moreover, if the user finds the text on the card too small to read, they can touch the

card, then the screen will only display one card in landscape mode. There they can go back to the Pokédex by pressing the big cross button (see Figure 1.4.4-5).



Figure 1.4.4-4 Pokédex Card Before and After Flip



Figure 1.4.4-5 A Card in Pokédex in Full Screen Mode

2 Project Diary

2.1 Information and Processing Needs

Having analyzed the users and the target of the project, we both decided to make a 2D top-down mobile game that is like Pokémon Go. The player explores in an environment which looks like the Belval campus with some buildings for each of the five departments of the faculty of FSTM.

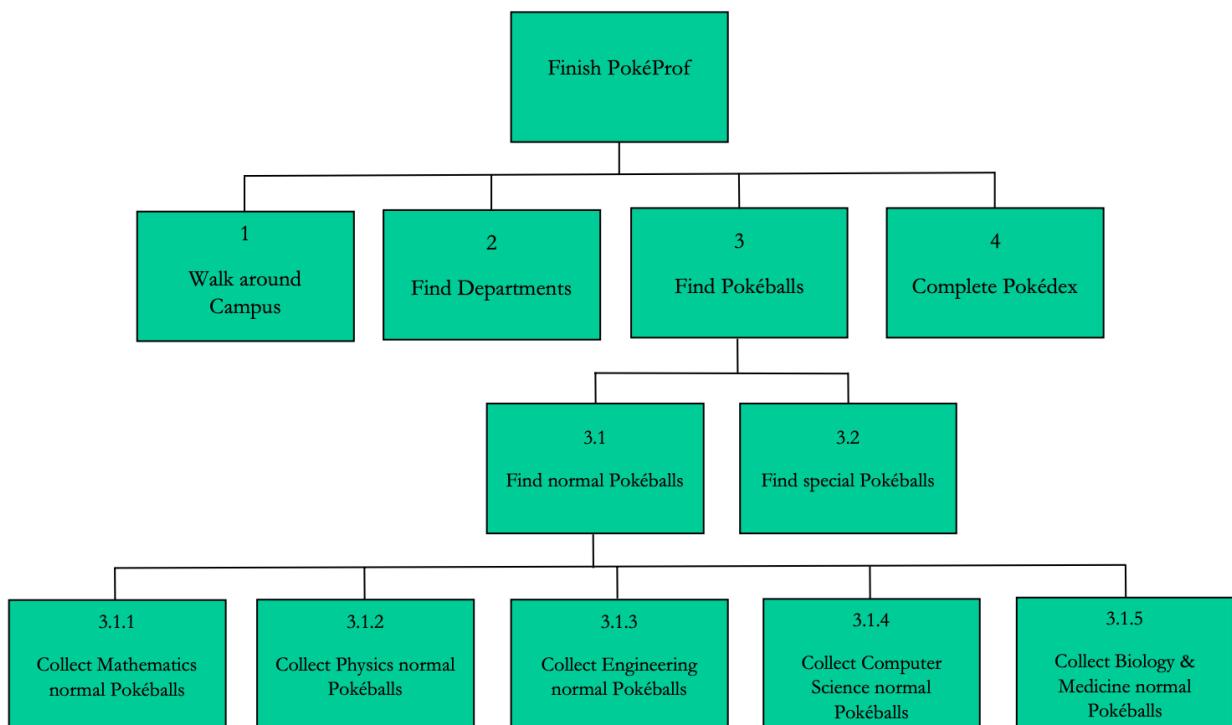
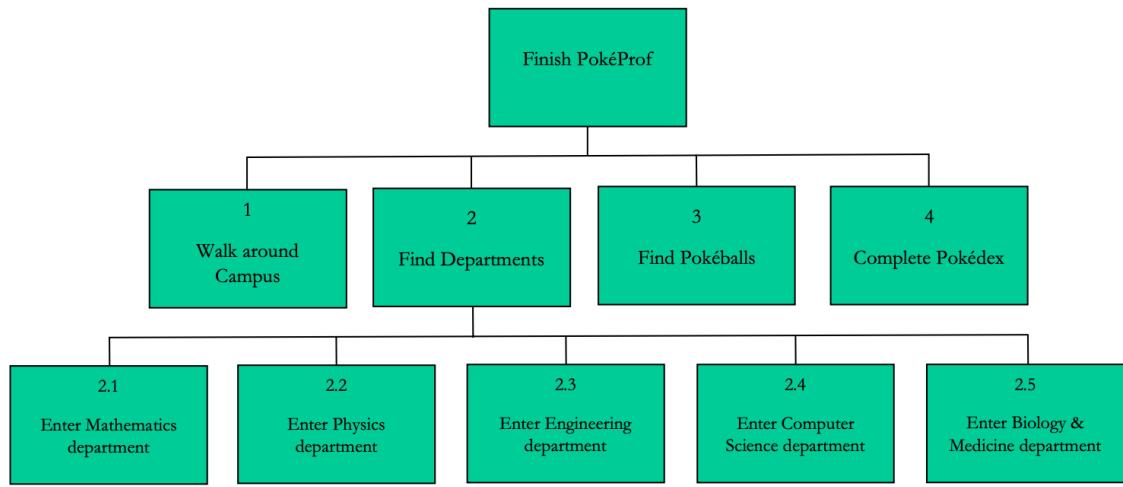
While progressing through the game, the player encounters some university staff mainly course directors and heads of departments, called the PokéProf. The user can capture them with specific Pokéballs corresponding to each department and each job position, (normal Pokéballs for course directors and special ones for the heads of departments). In this way, the player can learn about the faculty staff. The goal is to complete the collection of the PokéProves whose information is accessible in the Pokédex. Clearly the main subject of the game is the professors. Therefore, we name our game as “PokéProf”. We have made a trailer and a gameplay video available on YouTube¹.

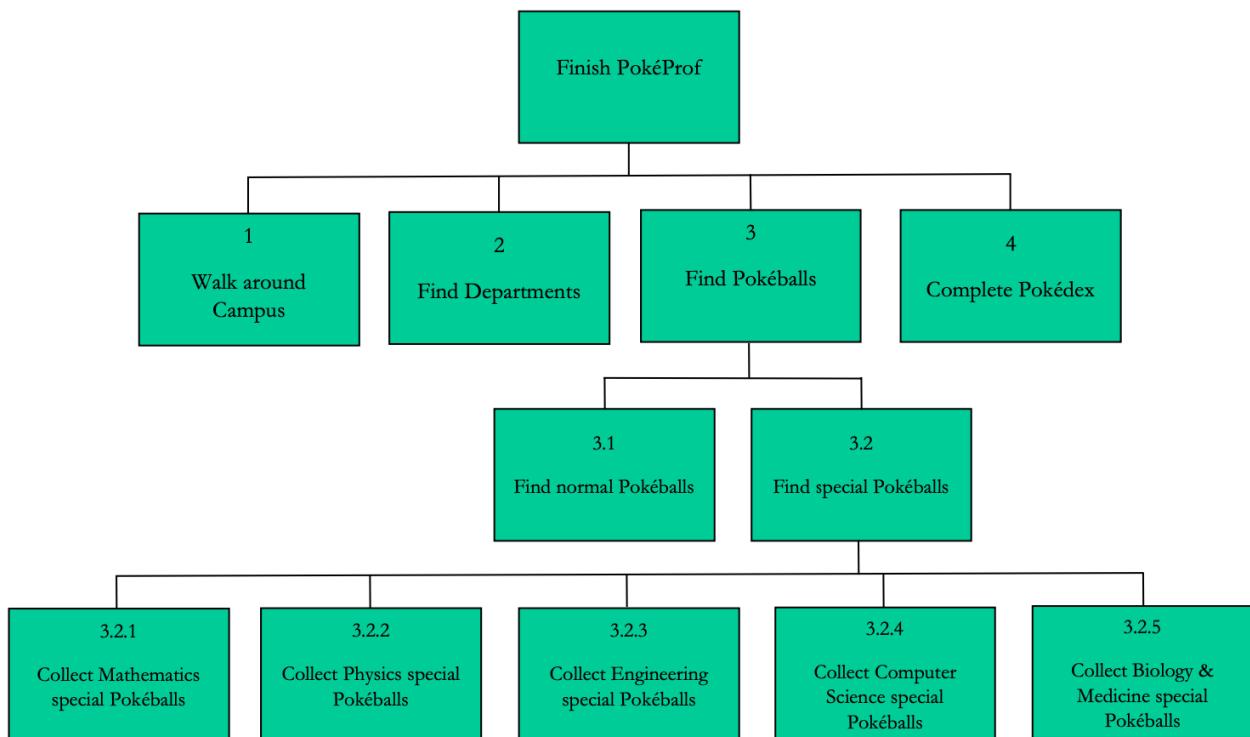
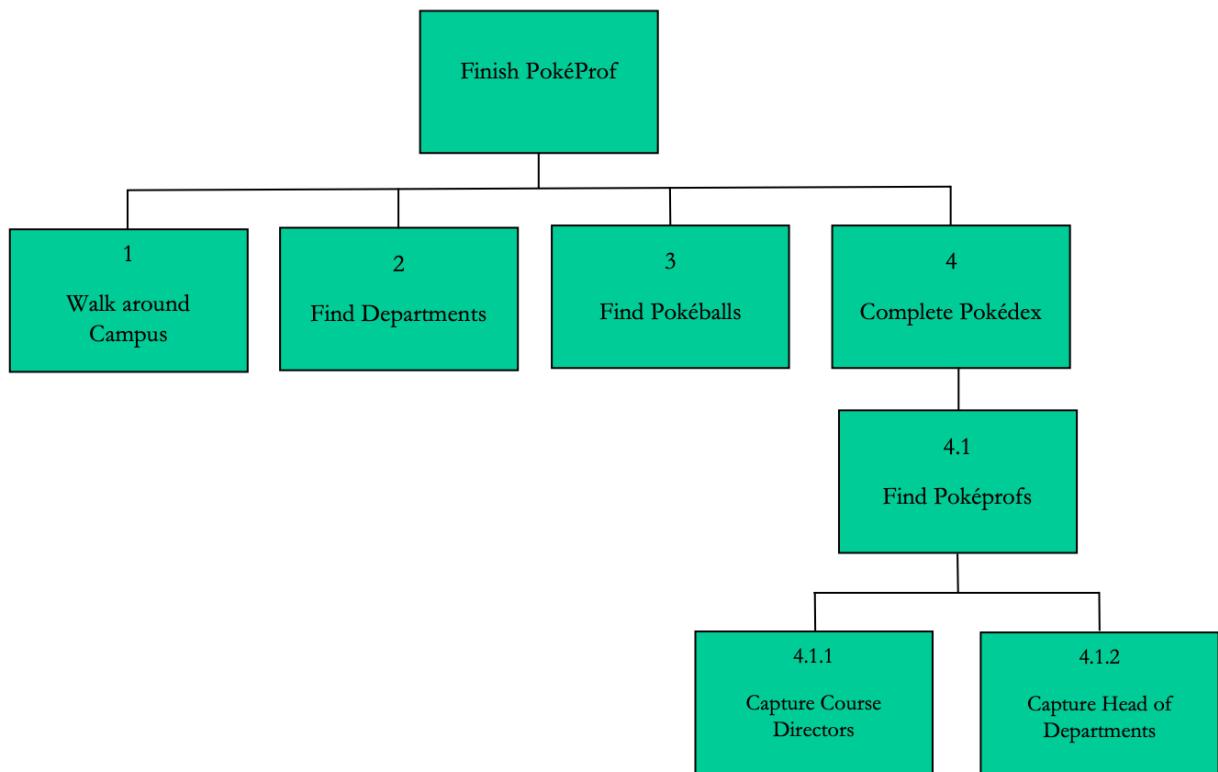
2.2 User Data Gathering

As stated before, there are two types of targeted users: university members including the students and the staff, and potential newcomers who can probably have access to the game on the university open day. In order to gather information on the users, we invited some of the university members and our friends to test the program, and observed them while they played the game. The game is possibly the first direct interaction the users have with the faculty. Hence as its developers, we need to make the game instructional so that the users will not get lost in the application, and to provide good gaming experience in order to leave the player a good first impression on the faculty. The Hierarchical Task Analysis is as follows:

¹ Link to the trailer: <https://www.youtube.com/watch?v=fkZfGOubEzw>

Link to the gameplay video: <https://www.youtube.com/watch?v=8vbNCHDuA7c>





2.3 Prototypes

As explained before, there are some key concepts to be implemented into the game. At the early stage of the development, we designed our first prototype, and shortly afterwards we improved it into another one.

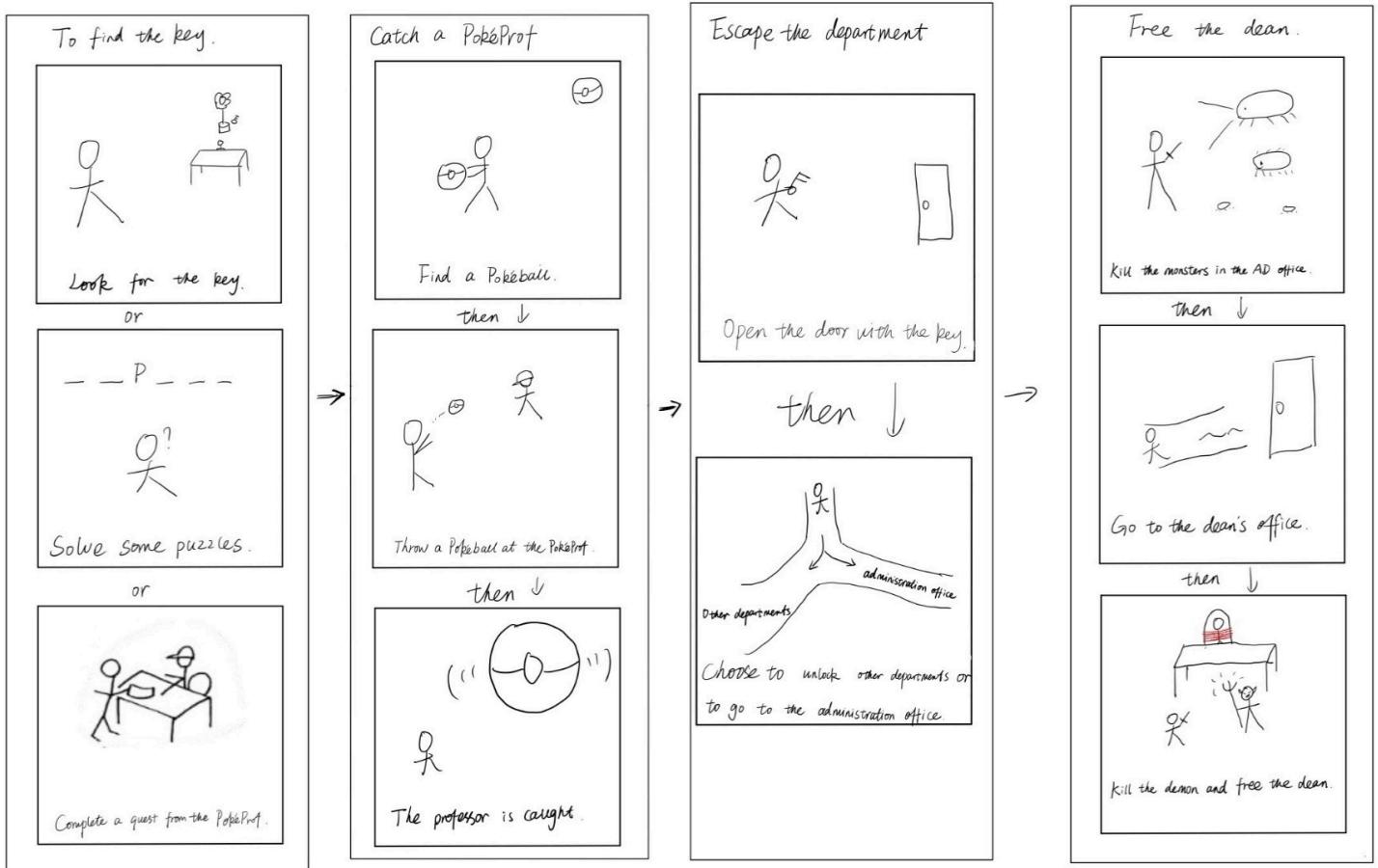


Figure 2.3-1 Story Board of Prototype 1

Figure 2.3-1 demonstrates our very first idea on the game. The game starts in one of the five departments who are all locked. To unlock them, the player needs to find five keys either by searching for them, solving some puzzles or completing quests given by the PokéProfs in the rooms. The player can also capture the PokéProfs with some Pokéballs. After escaping the first department, they can either go to other departments to catch their professors or directly make their way to the administration office to kill the monsters there. Afterwards, they can have access to the dean's office and battle with the final boss to free the dean. If the player decides to not capture all PokéProfs before going to save the dean, he can fail defeating the villain since the PokéProfs have different skills and power to help with the fight.

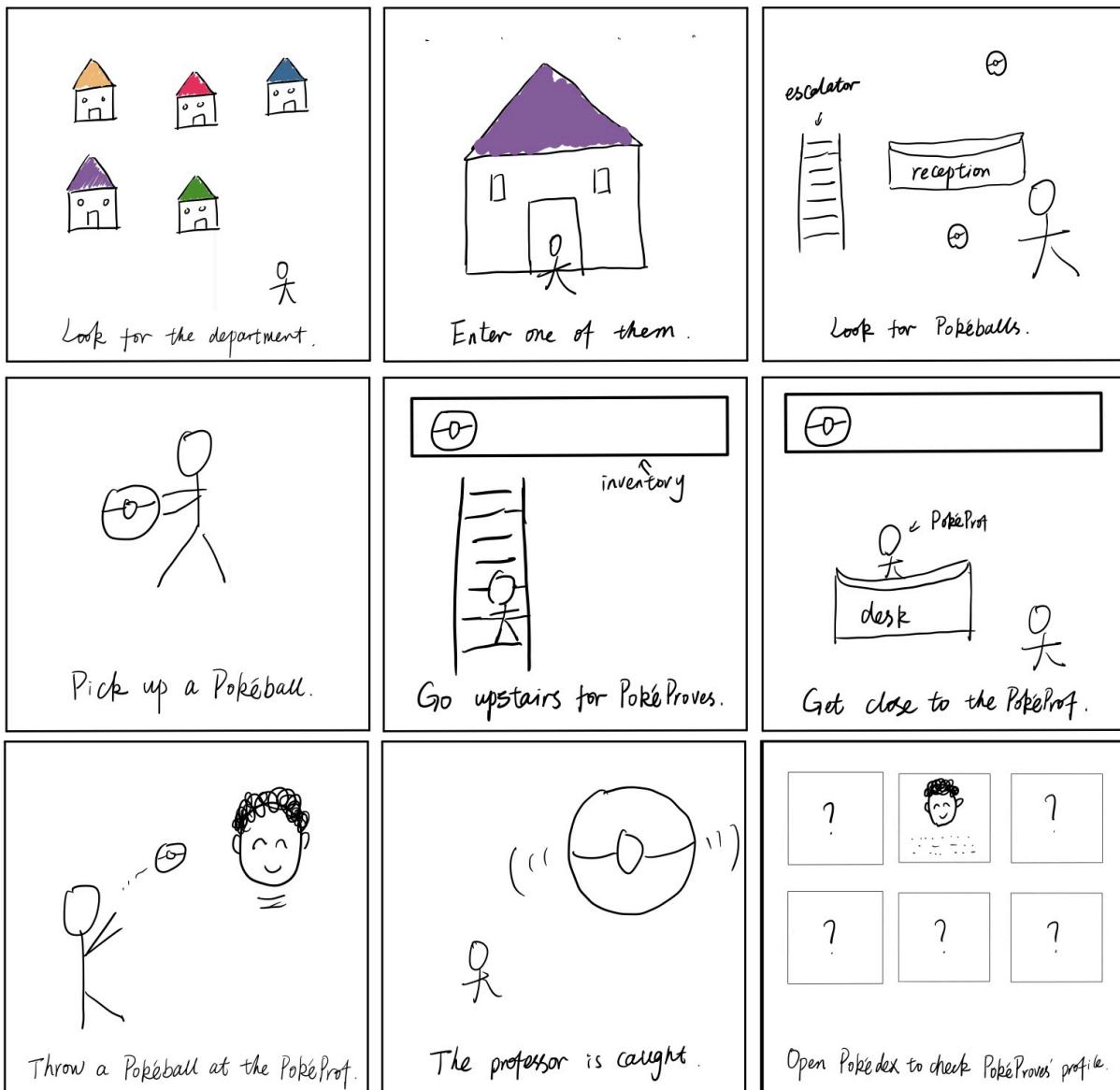


Figure 2.3-2 Story Board of Prototype 2

The second prototype is the one we finally applied to our project. There are five departments building located in a Belval-like environment. The player needs to find those departments, and inside each of them they can collect some Pokéballs of two types, the normal ones for the course directors and the special ones for the heads of departments. With the balls, they can capture the PokéProves. As a PokéProf is captured, the user can get to know him by opening the Pokédex and looking at his card where some information about him is written. To finish the game, the player needs to capture every PokéProf.

3 Testing Plan

During the development of the game and after the release, it is necessary to test the game to verify if it corresponds to the users' requirements and meets the usability criteria we made before. Hence, we led some tests by observing users during several play-test sessions and asking about their opinions via interview. We had two university outsiders and two students from the university as representatives to test the game.

We adopted the method Quick & Dirty in the first play test. We sent the game to a few friends, and they gave us some feedbacks online. It is not official but timely and efficient. We received helpful suggestion mainly on the UI design. Figure 1.4.3-1 is the first version of the game GUI design that we tested on in this test. In general, the interviewees found that the interact button was too small. The other icons on the bottom right were also small and close to one another. As a consequence, the user often miss-clicked the button. Most problematically, the joystick at the bottom left almost covered the whole area, masking the scene below. The choice of the icons was not very instructional, either. We chose a Pokéball as the symbol for the quest tab and a console for the pause menu, which was confusing for the users because the symbols and the functionalities of the tabs are not relevant. These reviews truly reflected the users' gaming experience. Hence we decided to re-work on a completely new UI that is much more user-friendly.

Figure 1.4.3-3 shows the final version of the game UI. There we move all the other buttons on the bottom right elsewhere, leaving only the interact button that is able to take more place there. The inventory is displayed on the top without having to click any button, so that the player can always see what items they possess. The console icon for the pause functional has been replaced by a pause symbol, lying on the top right corner of the screen. The quest button to open the quest tab is indicated by an arrow at the top left. In sum, the UI satisfies our usability criteria because it becomes easy to understand and to use.

One of the other usability criteria is to have the player movement system that can be adapted to users' preferences. To achieve that, we made a functionality where the movement controlling joystick moves to where the finger touches. That is to say, the player can touch anywhere on the screen to manipulate the movement of the player character, and the joystick occurs where the finger touches on the screen (see Figure 3.1 as an example).



Figure 3.1 Joystick Movement

Another usability criteria is to have a flexible UI suited the screen sizes of different mobile phones. To test that, we conducted a more advanced play-test with the last version of the UI, in controlled environments where we were face-to-face to the tester. We observed him with questions, such as how he played the game, how he used the UI, whether it was intuitive or not, whether there was any performance issue due to the phone model, whether the response time (loading time, transition time) fitted our usability criteria or not, etc.

Before the second play test, we had a concern about some performance issues that we developers encountered while testing the game. Usually, we tested the game on an emulator to simulate a phone and it worked fine. However, when we tested the game on our own phone, once we captured a PokéProf and then opened the Pokédex, it was very laggy. We cannot figure out if the performance issue was due to our relatively old phone model or else. Therefore, during this play test, we paid attention to this issue and found out that it also happened on some testers' mobile phones. There we concluded that it was indeed a performance issue which can be and has been fixed in the later stage of development.

One last usability criteria checked during the testing phase was on the possible inconsistencies throughout different game plays. For example, at the beginning of the project development, we had a bug where the player exited a department, they sometimes got stuck in the water ponds that were too close to the building doors. Hence, the testers could encounter the same issue and we have fixed it by moving the water ponds further away.

References

- [1] Christiano, A., & Neimand, A. (2017). Stop Raising Awareness Already. *Stanford Social Innovation Review*, 15(2), 34–41. <https://doi.org/10.48558/7MA6-J918>.
- [2] Christiano, A., & Neimand, A. (2018). The Science of What Makes People Care. *Stanford Social Innovation Review*, 16(4), 26–33. <https://doi.org/10.48558/GW2V-5279>.